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XII. *An Account of the Observations made in Providence, in the State of Rhode-Island, of the Eclipse of the Sun, which happened the 23d Day of April, 1781.* By BENJAMIN WEST, Esquire, F. A. A. Communicated by the Reverend President WILLARD.

I HAVE thought proper to draw up a particular account of this eclipse, as well knowing that proper observations of eclipses make an important article in the theory of astronomy. It was by these kind of observations the lunar theory was bro't to it's present degree of perfection : And every Astronomer knows of what consequence it is to navigation, to have the moon's motion settled to a certain degree of accuracy.

This eclipse was observed in *Providence* by Mr. *Joseph Brown* and myself, at Mr. *Brown's* house. The morning of the 23d of April was cloudy, and I despaired of seeing the sun that day ; but a little before twelve o'clock, the clouds seemed to break, and the sun, now and then, made it's appearance, which gave me some hopes of seeing some part of the eclipse : But after twelve o'clock the sun was again obscured by the clouds, and remained so till five or six minutes after the first contact of the sun's and moon's limb, when we had again a slight view of the sun through the clouds, and saw the eclipse was coming on. The air continued unfavourable to our observation till a few minutes before the middle of the eclipse, when the sun again appeared, and gave us a good opportunity of observing the quantity of the eclipse when at the greatest ;—for which purpose, Mr. *Brown* applied the micrometer, and found the lucid part of the sun, when in its least state, 1288 microm-

ter measure. This was not done at a single operation, but by a number of trials, till he found the bright part of the sun was in it's least state. After reading off the numbers from the micrometer for the quantity of the eclipse, Mr. *Brown* immediately, at my request, took the length of the chord joining the cusps, which I believe was done with great care, and found it 1380. The micrometer measures for the sun's diameter was 1906. Then $1906 - 1288 = 618$, the eclipsed part, and $\frac{618 \times 12}{1906} = 3^{\circ} 53'$ digits for the greatest quantity of the eclipse. From the table which we made for the micrometer in the year 1769, the sun's apparent diameter was $31' 53''$, exactly agreeing with what *Mayer's* tables make it. I found the apparent diameter of the moon by the following method:—Let GFI be the sun, and HEB the moon, and EF the chord joining the sun's cusps. Now, as BG is a straight line, bisecting the straight EF at right-angles, it must therefore pass through the centers both of the sun and moon. (*Euclid* 1. III.) The angle ADE is a right-angle, and AE and ED are given quantities. Then $\sqrt{AE^2 - DE^2} = AD$. (Per *Euclid* 47. I.)

$$\begin{array}{rcl}
 AE & = & 953 \\
 DE & = & 690 \\
 \hline
 \text{Sum} & = & 1643 \quad 3.2156376 \\
 \hline
 \text{Difference} & = & 263 \quad 2.4199557 \\
 & & \hline
 & & 2)5.6355933 \\
 & & \hline
 AD & = & 657,2 \quad 2.8177966 \\
 AG & = & 953 \\
 \hline
 DG & = & 1610,2 \\
 GH & = & 1288 \\
 \hline
 HD & = & 322,3
 \end{array}$$

The angle BEH, in a semi-circle, is a right-angle, (*Euc.* 31. III.) and HD, DE, DB, are three proportionals, (*Euc.* 8. VI.) that is to say, $HD : DE :: ED : DB$.

$$DE = 690 \quad 2.8388491$$

x 2

$$\begin{array}{r} \text{HD} \quad 322,3 \quad 5.6776982 \\ \hline 2 \quad 5082603 \end{array}$$

$$BD = 1477,2 \quad 3 \quad 1694379$$

HB = 1299,5 the micrometer measure for the moon's diameter. It is a thing well known to mathematicians, that the sines of small arcs are nearly equal to the arcs themselves; hence we have a rule to find the moon's apparent diameter by proportions.

☉'s micrometer measure 1906,	Log.	3 2801
It's \angle , 31' 53",	LL	7517
☾'s micrometer measure 1799,5	6° ar. 6	7449
☾'s apparent diameter, 30' 6",	LL	7767
Deduct — 23 for the moon's elevation.		

☾'s horizontal diam. 29 43, but one second more than what is given from *Mayer's* tables.

Mr. *Brown* and myself both noted the same second for the last contact, which was at 2^h 53' 36" apparent time. There were some thin white clouds about the sun, yet I think the observation was pretty good.

